and bread. The meat should be of the richest quality, and have at least one-third of its weight of fat. If the patient like salad oil, it may be eaten as freely as possible. A small quantity of cheese should be added to the dinner. An egg should be taken at the tea meal, and also at supper when milk is not taken. There should also be a cup of milk and bread and butter placed at the bedside of the patient, and eaten, if possible, during the night. Beer or wine may be taken at dinner and once or twice at other periods of the day, if it be found to agree with the system, and the dose be so moderated that it may not in the least affect the head, or cause heaviness in, and indisposition to move the limbs. Usually wine should be taken with hot water; but when the progress of the case is satisfactory, alcohols are not necessary. All food should be taken hot, and prepared so as to please the taste of the patient." (p. 329.)

The reader will perhaps be led to say that the author gives the patient but little time to do aught else than to eat. Exclusive of out-door exercise, he cannot do anything more conducive to his welfare. There is, of course, a limit to dietetic measures; the digestive powers must not be overtasked, but their fullest capabilities are to be made available, and this can be done by systematic, persevering efforts to a far greater extent than is generally supposed.

Dr. Smith recommends the practice of promoting expansion of the lungs by voluntary efforts of deep inspiration. Whatever advantage accrues from this, may be obtained, as it seems to us, by muscular exercise in the open air.

The remedies which he deems useful with reference to the arrest of tuberculous disease, are chiefly those which promote appetite and digestion. For these objects he advises the tinct. ferri sesquichloridi, or the citrate of iron and quinine, with some of the bitter infusions. Cod-liver oil is advisable when tolerated. For the cough he considers the best remedy to be 1-16th or 1-12th of a grain of morphia in mucilage or syrup.

The last seventy pages of the work are devoted to the climatic advantages of certain situations, viz., Scarborough, the Isle of Man, Scotland, Switzerland, various parts of England, the Nile, Pau, Madeira, and Rome. He presents details respecting humidity, mean temperature, etc., of several of these situations.

In taking leave of the work, we would express the hope that the author will furnish occasions for a renewal of our intercourse as a reader, if not as a reviewer. A. F.

ART. XVI.—*On Asthma; its Pathology and Treatment.* By HENRY HYDE SALTER, M.D., F.R.S. London, 1860. 8vo. pp. 372.

THE only sure foundation for the rational treatment of a disease, is an accurate knowledge of the pathological elements which it involves, and its separation as a morbid entity from all analogous affections, as well as from the phenomena which accidentally become attached to it. When this object has been attained, and then only, does it become possible to discover its pathogenesis, or accurately to determine the value and the mode of operation of the several remedies which are employed for its cure. So in chemistry the isolation of a substance from its associated substances forms the preliminary step to an investigation of its nature and habitudes. Without such an isolation of a disease, all discussions respecting its nature lead to results as imperfect or erroneous as the estimate of a chemical element does which has never been examined except in combination. It is often claimed that the great glory of natural science in the present age is the application of a rigorous method of analysis to its study; but this is quite as true of human physiology and pathology as it is of any among the sister sciences. Indeed, if we examine the progress of medicine during the last half century, we shall be convinced that a very large proportion of it has been achieved by the separation of morbid states which were previously confounded, or which were only imperfectly distinguished from one another, and by the subsequent experimental application to each of them of different methods of cure.

Such a work has been performed for "Asthma" in the volume which we propose to examine, its object being to prove "that asthma is essentially, and, with perhaps the exception of a single class of cases (the humoral), exclusively, a nervous disease: that the nervous system is the seat of the essential pathological condition."

The author devotes some space to refuting certain theories, and particularly Dr. Bree's hypothesis that the phenomena of the asthmatic paroxysm are due to an extraordinary effort to get rid of some peccant and irritating matter existing in the air tubes. But this, we think, is labour lost; for the hypothesis is purely and simply gratuitous, nothing whatever having been brought forward by its author which is capable of affording it the slightest foundation. If he had possessed the light afforded by more recent observation, he would probably have modified his views so as to embrace the numerous instances cited elsewhere in the present work, which appear to prove that certain substances after digestion and absorption act as specific irritants upon the lungs. But this theory involves the element of spasm, which Dr. Bree did not accept. Equally illogical, and founded upon unreal pathological conditions, are the notions that asthma depends upon bronchial mucus, or upon thickening of the lining membrane of the bronchia. Evidently, these permanent conditions cannot be invoked to account for phenomena the characteristic peculiarity of which is their sudden occurrence in the midst of apparently good health, and often without the intervention of any palpable exciting cause. It deserves to be remarked, in the words of Sir John Floyer, that "the lungs do not appear to be much oppressed with phlegm before the fit; and at the end of the fit the straitness goes off before any considerable quantity is spit up." Dr. Mason Good quotes this passage as describing what he himself had witnessed, and in opposition to the theory of Dr. Bree, and elsewhere refers to the fact it describes as proving evidently "that the inner membrane of the bronchial vessels is in a state of peculiar dryness." (*Study of Medicine*, i. 557.) Certain speculatists conceive that there is a specific something circulating in the blood whose property it is to excite asthmatic attacks. We find, it is true, that particular articles of food, almost as various as the cases of the disease are numerous, tend habitually in the same person to develop the paroxysms; but these facts evidently prove the peculiar susceptibility of the patient himself rather than the special virulence of the noxious agent; they indicate, indeed, a nervous rather than a humoral pathology for the affection. The late Dr. Todd, like Dr. Bree, argued in favour of a special *materies morbi*, because, according to him, asthma in many points resembles gout. Dr. Salter thinks it worth while to state this theory at length and seriously to refute it. The reputation of its author may have seemed to require this trouble; the theory itself certainly did not.

During the prevalence of doctrines which emanated from the school of the pathological anatomists, it was difficult to procure belief in the existence of any disease which did not impress upon the organs a material change. When not even the primary lesions of the inflammatory process could be detected, a state called irritation was assumed to exist, which appears to have been a hypothetical organic nisus towards inflammation. It had little in common with that sort of impression upon one portion of the nervous system which awakens action in another, and perhaps distant part, a phenomenon which belongs to the province of nervous pathology, and which, although formerly recognized distinctly, did not until recently become familiar as a mode of morbid as well as of normal action. It is, indeed, hardly to be wondered at, that the brilliant discoveries made of the connection between symptoms and organic lesions should for a period have blinded pathologists to the nervous elements of disease, and that the idea of purely nervous affections should have excited a feeling not unlike derision. We may, therefore, pardon so accomplished a physician as Dr. George Budd when, as late as 1840, he avowed his scepticism in regard to the existence of pure nervous asthma; and we cannot feel great surprise that Laennec himself should have been obliged to say that "among contemporary physicians, who have most cultivated morbid anatomy, many altogether deny the possibility of spasmodic dyspnœa, and most of the others are disposed to embrace the same opinion." In 1817, Rostan attributed all cases of asthma to diseases of the heart or of the great vessels. Broussais held the same doctrine; and in 1844, the learned commentator, Dr. Adams, wrote: "It seems likely that the paroxysm is occasioned by thick and viscid mucus infarcted in the lungs." Even M. Beau, the dexterous physical diagnostician, appears to have used his peculiar skill only as guide to error in this matter; for he, like the writer just named, attributes all the phenomena of asthma to bronchitis. Nor did he so in ignorance of the doctrine of bronchial spasm; since he blames those who maintain it for an undue deference to medical tradition.

There is another theory from which Dr. Salter dissents, not because it ignores the nature of the elements involved in asthma, but because it imposes a wrong interpretation upon the phenomena of the disease; it is that which attributes them to *paralysis* of the bronchial tubes. To this he objects as involving the supposition that the tubes are agents of respiration, a supposition to which, in common with Dr. Budd, he emphatically objects, because "respiration is under the influence of the will, while the contraction of the bronchial tubes is essentially involuntary." According to Dr. Budd, we should, therefore, by quickening the respiratory acts, speedily cause the proper accordance between the dilatation of the chest and that of the bronchia to cease, and the one to dilate while the others were contracting. This would, certainly, be the case if the rate of movement of the muscles of the bronchia were uniformly the same; but for such a supposition there is no ground whatever. The muscles of the heart, of the intestines, &c., contract more or less rapidly according to the more or less frequent renewal of the stimulus which excites them, and no idea of normal muscular contraction of the bronchia can be conceived which does not imply its perfect reciprocity with those general thoracic movements which are involved in the respiratory act. To say that respiration "is under the influence of the will," implies the movement at a quicker or slower rate of *all* the muscles concerned in that act, bronchial as well as thoracic; and we are not authorized to assume for the latter and deny to the former a subjection to volition, when it is evident that both must move simultaneously, or at least co-ordinately. Besides, it is scarcely correct to oppose these two sets of muscles as voluntary and involuntary. The thoracic muscles have the one character or the other, according to circumstances. However we may, for a limited period, by an act of volition, control the rate of their movements, they are none the less involuntary muscles during sleep and in all other states of unconsciousness.

But because the movements of the bronchial muscles must be synchronous with those of the chest, whatever their rate of motion, it does not follow that in asthma the former are paralyzed. Nor do we perceive the validity of the admission made by Dr. Salter that this view would lend a ready explanation to "the extreme difficulty and prolongation of expiration." On the contrary, it would seem as if the air should be more rapidly expelled in expiration if the bronchia opposed no obstacle to its escape, such as would exist if they were contracted, provided the contractility of the lungs remained unimpaired. Another reason which, in the opinion of Dr. S., favours the paralysis theory, is "the permanent state of distension at which the chest is kept during the asthmatic paroxysm." But if this state does not exist, as an essential part of the paroxysm (which we shall endeavour to make probable), the theory is no longer to be entertained.

The second chapter of the present work sets forth the doctrine, which it is one of the author's principal objects to expound, viz., that asthma is essentially a nervous disease. This proposition is very fully and very ably demonstrated. The causes, it is shown, are chiefly such as operate upon the nervous system, among which mental influences hold a conspicuous place, and particularly sudden alarm and other emotional excitements. These are equally remarkable for suspending or arresting the paroxysm in many cases. The most efficient remedies are from among those which act upon the nervous system, and in an especial manner certain narcotics and antispasmodics. The periodical recurrence of the attacks, and particularly their proneness to take place at night when the susceptibility of the nervous system is peculiarly alive; the copious excretion of limpid urine, the neuralgia and frontal headache, the antecedent drowsiness and languor, or, on the other hand, the unwonted hilarity and animation which often precede the paroxysms, are phenomena of the same class.

The second proposition of Dr. Salter is—

> "That the phenomena of asthma—the distressing sensation, and the demand for extraordinary respiratory efforts—immediately depend upon a spastic contraction of the fibre-cells of organic muscle, which minute anatomy has demonstrated to exist in the bronchial tubes."

After showing that these phenomena are not to be ascribed to heart disease, bronchitis, or emphysema, the author calls attention to the fixed and rigid immobility of the thoracic walls, and the absence of respiratory murmur during the paroxysm, even while the external muscles are labouring by violent action to move the chest. In other words, the distress of the patient is evidently owing to the difficulty which the air experiences in reaching the pulmonary vesicles, not because the external muscles prevent it—for their action is intermittent, and, as far as it goes, would tend to dilate the chest and introduce the air for lack of which the patient is suffering—but because the muscles of the bronchia themselves diminish the calibre of these canals, and, by preventing the ingress of air, render the efforts of the external muscles abortive. An additional evidence of this fact is the existence of sibilant rhonchi and wheezing, which can only be caused, in the absence of mucus, by the irregular contraction of the tubes themselves.

> "Thus we see," remarks Dr. S., "by evidence as certain as sight, that in asthma bronchial spasm must and does exist, and that no other conceivable supposition will explain the phenomena."

The author then alludes to the anatomical proofs of the existence of circular muscular fibres in the bronchia, even to their minutest divisions, and points out how wide-spread their connection is with various organs through the vagus nerve, the cervical portion of the sympathetic, and the anterior and posterior pulmonary plexus. He also refers to the experiments of Volkmann, Williams, and others, which prove that the bronchial tubes undergo contraction, even to complete occlusion, from the application of various stimuli both to the tubes themselves and to the trunks of the pneumogastric nerves.

It would, we think, have added force to the author's reasoning had he informed his readers that the doctrine of the muscularity of the bronchial tubes, and of the spasmodic nature of asthma, dates far back of the discoveries and experiments to which he alludes; far back, also, of the demonstration of the circular fibres by Reisseissen (1821), which Dr. Copland claims as his own, and Cruveilhier adjudges to himself; and even from an earlier period than Cullen, of whom Dr. Budd says, "Since the time of Cullen, the muscularity of these fibres has been adduced to explain the symptoms of asthma." Indeed, after WILLIS wrote, the existence of bronchial muscular fibres was as fully admitted as that of the muscles of the larynx itself. Nothing can be more explicit than the description which this author first published in 1673. After describing the straight and circular fibres of the trachea, he says:—

> "The coats of the bronchia have muscular fibres of both kinds; from whence we may conclude that all the lesser pipes of the aspera arteria have their constant turns of systole and diastole, viz: all the pipes are contracted when we breathe out, and relaxed while we suck in air."

This, let it be remarked, is also the very furthest and latest conclusion of modern physiology on the subject.

When Willis would explain the phenomena of asthma, he says:—

> "The animal spirits destined to the function of breathing . . . . enter inordinately into the fibres, as well *nervous* as *moving*, of the organs of breathing, and make them for that one cause one while to be contracted, another while to be distended, irregularly, as also their solemn and equal turns of systole and diastole to be variously disturbed and hindered." (*Of the Medicines of the Thorax*, 1684.)

Finally, he places the immediate cause of the paroxysm either—1, in the muscular fibres; or 2, in the nervous branches; or 3, in the brain. If for *brain* we write *nervous centres*, we shall find in Willis the essence of the modern pathology of asthma.

Let it be further remarked that Willis refers to the belief of the ancients, and of his own cotemporaries, that all asthma depends on mechanical obstructions of the air-passages, while he himself admits asthma from mechanical, and asthma from spasmodic—or, as he terms them, convulsive—causes. He even goes further, and points out how an asthma which was at first mechanical only may become convulsive also, just as we see spasmodic asthma superadded to dyspnœa produced by vesicular emphysema.

"Hence," he says, "it may be concluded that every asthma is a mixed affection, stirred up by the default partly of the lungs ill-formed, and partly by a default of the nerves and nervous fibres appertaining to the breathing part."

If we apply this remark to the confirmed disease, it expresses precisely what the most recent and accurate observation has taught.

BONETUS, the cotemporary of Willis, in France, and scarcely less eminent, followed in the same doctrine. There are, he says,

> "Several causes of dyspnœa;" the air tubes may be "choked up, compressed, or *too closely contracted.*" . . . "The branches of the trachea sometimes, *their fibres being spasmodically affected*, are too much drawn up and quite closed, and prevent the ingress of air necessary for respiration. Hence, although no obstruction exists in the lung, or any malformation, or any consumptive diathesis, yet these fibres being preternaturally convulsed, and at the same time contracted, terrible paroxysms of asthma often occur." (*Sepulchretum*, i. 385.)

Again, in England, a few years later (1698), was published a work which is still, and must remain, a classic in the literature of asthma. In this, Sir JOHN FLOYER says (p. 8):—

> "The muscular fibres of the bronchia and vesiculæ of the lungs are contracted, and that produces the wheezing noise which is most observable in expiration."

And again (p. 43):—

> "This contraction *of the vesiculæ* is very probable, because the bronchia are contracted and *the vesiculæ have the same muscular fibres* to help respiration, by which they may be drawn up so as not to admit air."

Muscular fibres of the vesiculæ! Once more a literal anticipation of the farthest reach of our anatomical research, advanced as we are more than a century and a half beyond Floyer upon the road of scientific discovery.

Without going back to Van Helmont, who, even before Willis, attributed the phenomena of asthma to spasm of the air-tubes, we must not omit noticing the testimony of that giant among modern physicians, FREDERIC HOFFMANN. In 1707, he wrote as follows:—

> "While the diaphragm, the intercostals, and the *sensitive membrane which everywhere lines the pulmonary cells* are spasmodically contracted, the capacity of the chest is contracted, expansion of the lungs is prevented, the entrance of sufficient air into the lung-cells is hindered," &c. (*De Asthmate Convulsivo*, 1707.)

In studying such a subject as this, we must not forget to consult WHYTT, who in so many points was in advance of his scientific cotemporaries. He defines (*Observations*, &c., 1764, p. 260) spasmodic asthma to be—

> "That species of difficult breathing which is not owing to any obstruction in the lungs, or load of humours compressing their vessels, but to *an uncommon contraction of their bronchial tubes and vesicles*, whereby they do not yield as usual to the pressure of the air in inspiration."

CULLEN, too, a few years later (1772) wrote, "The proximate cause of this disease is a preternatural, and, in some measure, a *spasmodic constriction of the muscular fibres of the bronchiæ.*"

It appears, then, that from the time of Willis, at least, the distinction of nervous asthma from dyspnœa produced by physical causes was fully recognized, and that during nearly the first half of the present century those who would not admit it to be a disease because it left no lesion in the body, were as ignorant of the subject as the ancients were, but without the same excuse for their ignorance. It appears further that they who ascribe our more accurate knowledge of the nature of asthma to the discovery of the bronchial muscles by Reisseissen, or other cotemporary anatomists, are but imperfectly acquainted with the literary history of asthmatic affections.

It is unnecessary to enumerate the names of all among more recent pathologists who have taught the doctrine that nervous asthma depends on bronchial spasm. But some of them may be referred to. Laennec (ii. 179) says:—

> "When full inspirations are inadequate to make the air reach the pulmonary vesicles, the fact can be attributed only to a *spasm of the vesicles themselves*, or, at least, of the small bronchial ramifications."

The same doctrine is maintained by Georget, Lefévre, Copland, Wunderlich, Grisolle, Romberg, Trousseau, Walshe, and all others whose conclusions are authoritative.

It may be proper to mention that Dr. Budd (*Med.-Chir. Trans.*, xxiii. 62) and Dr. Kidd (*Dub. Quar.*, May, 1861, p. 296) attribute the phenomena of asthma to spasm, indeed, but spasm of the *external* muscles of respiration. It is sufficient to reply that the *external* muscles are not in a state of sustained spasmodic action in this disease, and except in tetanus they never are. In a word their contraction during the asthmatic paroxysm is voluntary and intermittent, while the dyspnœa is sustained and more or less permanent, and such as would be occasioned by involuntary muscles in spasmodic action.

As we have seen, among the objectors to the theory of bronchial spasm is Dr. Budd. He details some experiments with the galvanic apparatus applied to different portions of the air tubes, and declares that no contraction can be produced by its means either in the bronchial tubes or in the trachea. He also quotes the experiments of WEDEMEYER to the same purpose. But, evidently, by proving too much they prove nothing. For the merest tyro in anatomy can demonstrate the muscularity of the trachea.

But it has been conclusively shown by the microscope and by physiological experiment that the bronchia are provided with muscular and contractile fibres. LONGET (*Physiol.*, i. 646, 1859), after detailing some experiments with the galvanic current on the pneumogastric nerves, and referring to the investigations of KÖLLIKER and MOLESCHOTT, concludes not only as to the certainty of the existence of muscular fibres in the minutest bronchia, but also as to the probability of their presence in the vesicular structure. He even maintains that such a supposition is necessary; for the act of expiration, either by the relaxation of the inspiratory muscles alone, or also with the active co-operation of the external expiratory muscles, would be unable to expel the mucus or even the foul air contained in the ultimate bronchia. Consequently, he argues, these bronchial and vesicular muscles are essential to the renewal of the air, to the permeability of the bronchia, and the maintenance of the respiratory function.

Quite recently Dr. RADCLIFFE HALL (*Braith. Retros.*, xlv. 76), without apparently being acquainted with LONGET'S argument, says:—

> "The smallest bronchial tubes are the most muscular;" . . . . . . "they contract rhythmically in quiet normal respiration, and by so doing quicken the expulsion of foul air from the air-cells, and accommodate the size of the tubes to the lessening bulk of the lungs."

He also holds that they contract partially towards the close of the inspiratory act, completing the propulsion of the air to the vesicles which the external muscles had begun, just as the capillary arteries by their own contractility propel the blood further which they received from the action of the heart and larger arteries.

It is no objection to this view that it implies a power in the minute bronchia of propulsion in either direction. A similar power is exerted by the stomach in ordinary vomiting, and by the small intestine when the vomiting is stercoraceous; also by the urethral muscles when they draw into the bladder foreign bodies placed in the urethra, and even by the vagina and uterus when they carry the seminal fluid to the ovaria.

Let it be added, however, that the doctrine of Dr. R. Hall, however original, is not new; it dates really from the last century.

In 1751 Whytt (*On the Vital and Involuntary Motions of Animals*, p. 170), speaking of the active agents in respiration, said: "The muscular fibres of the bronchia, by their contractile power, contribute to the expulsion of the air out of the lungs."

To return from this digression. Dr. Salter continues his demonstration by showing "that the phenomena of asthma are those of excito-motory or reflex action." Often they are developed by a mechanism similar to that which excites cough, the presence of some offending agent in the bronchia themselves, as various effluvia, dust, and other minute particles; more frequently gastric impressions made by irritating or too abundant food; sometimes by accumulated fecal matter; occasionally by a remoter impression still, as in a case where the attacks were brought on by the application of cold to the instep. In some rare instances the source of irritation producing the paroxysm appears to be central, as when an attack has preceded brain disease, or has taken the place of habitual epileptiform convulsions. Cases in which the cause of the attack is mental are evidently of central origin. Much importance is attached by the author to the *humoral* source of the paroxysms in numerous cases. Besides the reflex operation of gastric irritants through the pneumogastric nerve, the direct action upon the nerves of the lung by the products of digestion is, in his opinion, to be charged with producing asthmatic attacks. In many instances this effect appears to result, not from any intrinsically noxious quality of the articles of food employed, but to a special susceptibility to be influenced by some which are in themselves perfectly wholesome. The same peculiarity, it has already been stated, is noticeable in regard to effluvia. The articles of food which are prone to produce these effects are, in general, such as are crude and indigestible, among which may be mentioned cheese, nuts, raisins, confectionery, salted and highly seasoned food, and fermented drinks. Dr. Salter meets the very natural objection that these ingesta may occasion asthma by a reflex and not by a direct action on the lungs, by stating that they induce asthma in just such time as they would take to reach the lungs subsequent to their absorption, and that, as a general rule, in persons afflicted with an appropriate susceptibility, the rapidity with which the attack comes on depends upon the facility with which the particular article of food is absorbed. Thus, in a case which is referred to, the attack always followed immediately after taking wine or any alcoholic drink; while in another the food producing asthma was such as would furnish material for lacteal absorption, and the attack did not come on until two hours after the food was taken. In spite of these cases, the author is careful not to insist too strongly on the humoral origin of asthmatic attacks, remembering how often the susceptibility in question is associated with unquestionable dyspeptic disorder.

We cannot better conclude our notice of this portion of Dr. Salter's

Essay than by stating, in the author's own words, the connection between the muscularity of the bronchial tubes and the phenomena of asthma.

> "The purpose of this muscular furniture of the bronchial tubes is," he remarks, "that they should contract under certain circumstances, and on the application of certain stimuli; and seen by this light we recognize in asthma merely a morbid activity—an excess—of this natural endowment; the tubes fall into a state of contraction with a proneness, a readiness, that is morbid; the slightest thing will throw them into a state of spasm, the irritability of the muscles is exalted, the contraction violent and protracted, that becomes a stimulus to contraction which should not be, and the nervous and muscular system of the lungs is brought within the range of sources of irritation applied to such distant parts as ordinarily in no way affect them. Any healthy man may have his bronchial tubes temporarily thrown into a state of asthmatic spasm by the inhalation of ammoniacal or carburetted or other irritating gases; but only by such materials whose exclusion is necessary for the safety of the lungs, will this natural asthma be brought about. A greater degree of bronchial sensibility is shown in those cases, by no means uncommon, of what is called 'hay-asthma,' in which the stimulus to bronchial spasm is the effluvium of hay; a still greater, in those cases, much rarer, in which the emanations from ipecacuan powder will at once give rise to asthma; a still greater in that numerous class of cases of asthma in which the disease is called into activity by certain atmospheric peculiarities which are altogether inappreciable, as where an attack of asthma is inevitably brought on by going to a certain place, living in a certain house, sleeping in a certain room. All these cases fall strictly under what we may call the formula of health; they are physiological; they are instances of the contraction of a muscular tube in obedience to stimulus applied to the mucous membrane that lines that tube; the nervous system engaged is the *intrinsic* nervous system of the tubes, its own ganglia and perceptive and motor filaments, in the same way as in œsophageal deglutition or intestinal peristaltis; the error is merely a morbid exaltation of a normal irritability. But there are other cases in which the error is more than this, in which the nervous apparatus involved in the phenomena is abnormally extended; in which certain outlying and distant parts of the nervous system are the recipients of the stimuli that give rise to bronchial spasm, as in those cases to which I have referred, where an attack is induced by an error in diet, a loaded rectum, the application of cold to the instep, mental emotion; in which the gastric filaments of the pneumogastric nerves, the sympathetic, the cutaneous nerves of the foot and the brain, are respectively the recipients of the stimulus that gives rise to the bronchial contraction. In the former class of cases the bronchial spasm takes place in obedience to the wrong stimulus applied to the right place; in the latter, place and stimulus are alike wrong. . . . In what, then, does the peculiarity of the asthmatic essentially consist? Manifestly, in a morbid proclivity of the musculo-nervous system of his bronchial tubes to be thrown into a state of activity; the stimulus may be either immediately or remotely applied, but in either case would not normally be attended by any such result. There is no peculiarity in the stimulus; . . . nor, probably, is there any peculiarity in the irritability of the bronchial muscle; the peculiarity is confined to the link that connects these two—the nervous system, and consists in its perverted sensibility, in its receiving and transmitting on the muscle, as a stimulus to contraction, that of which it should take no cognizance. . . . These considerations, I think, tend to rationalize our notions of asthma, and to impart at once an interest and an order to its phenomena."

The clinical history of asthma is very fully related by our author, and in very graphic language, but our limits will not admit of any extracts. Among other things, he dwells upon the fact that the attacks so generally commence between three and six o'clock in the morning, illustrating the supremacy obtained by the excito-motory functions during the suspension of the will by sleep. He elsewhere (p. 178) points out the degree to which sleep exalts nervous action. He has omitted noticing, however, one of the most familiar examples from this class of facts, the occurrence of spasmodic croup uniformly at night, and its limitation to certain families or to individual members of such families, proving that in this disease, as in asthma, a special susceptibility is usually necessary to bring on an attack. Occasional exceptions to the law of nocturnal occurrence of the paroxysms are met with. M. Trousseau mentions one in which the attacks came on uniformly at eight o'clock in the morning, and Dr. Salter relates the singular case of a night porter who slept only by day, but who, nevertheless, had his fits of asthma about five or six in the morning when he was up and awake.

Dr. SALTER offers some remarks in regard to the capacity of the chest during the paroxysm, which have induced us to make it the subject of a little comparative analysis. His statement is as follows (p. 75):—

> "One result of the straining efforts to fill the chest is a permanent distension of it—its walls are kept fixed *in a condition of extreme inspiration.* So great is *the enlargement of the chest during the paroxysm*, that any article of dress that would ordinarily fit the waist cannot be brought together by two inches. But the chest is enlarged in every other way, the diaphragm therefore descends, the abdomen therefore seems fuller, and its girth is increased."

One of the most eminent of German physicians, WUNDERLICH, makes a somewhat similar statement, as follows:—

> "One form of asthma consists in a gradual augmentation of the dyspnœa, which reaches its maximum *at the end of two or three days. At this stage* the chest is almost motionless in spite of the most violent muscular efforts; the respiration rises to 60 or 80 in a minute, but is short and gasping; coarse sibilant and sonorous rhonchi are heard all over the lungs, the percussion *resonance is everywhere preserved*, and after many hours the limits of the chest are extended downwards. The liver also descends, the heart is thrust into the epigastrium, and *the thorax is excessively distended.*" (*Pathologie*, iii. 316.)

GRISOLLE (*Pathol. int.* ii. 745) says, "during the paroxysm the chest *is resonant*, often unnaturally so."

Dr. KIDD, also (*Dublin Quar.*, May, '61, p. 202), intimates that authors who have made a contrary statement did not know by actual observation what they were talking about, and assures us of his belief that a contracted "state of the thorax never exists in spasmodic asthma." On the contrary, he remarks, "*the thorax is distended to its greatest extent* . . . . so as to produce great fulness of the abdomen, and cause the heart's impulse to be felt at the scrobiculus." "The great difficulty," he concludes, "*is to empty the chest.*"

It may appear singular that in regard to a point of simple ocular observation there should be a divergence of opinion amounting to contradiction among different medical writers upon the subject of asthma. It will not do, with Dr. Kidd, to say that successive writers have copied from one another. This may be true of certain among them who compiled what they read rather than described what they saw; but it will not apply to the greater number, from some of whom the following citations are made.

We have already seen that HOFFMANN declares the capacity of the chest to be contracted during the paroxysm.

LAENNEC (ii. 386) describes the percussion resonance as *very moderate* in many cases.

Dr. C. J. B. WILLIAMS, one of the first English followers of Laennec, says:—

> "When bronchial spasm is considerable, the chest *may sound ill on percussion* . . . . . with a short, tight sound like that which the chest yields on forced expiration. This is caused by the *contracted state of the lungs* when under the influence of bronchial spasm." (Lib. Pract. Med., iii. 145.)

ROMBERG tells us (i. 328):—

> "'The patient feels that the air *does not pass beyond* a certain point of his thorax.' When the attack ceases suddenly, 'the air rushes violently into the bronchi and pulmonary vesicles into which *it had previously been precluded from entering*, and a puerile murmur is produced.'"

LEBERT (ii. 38) says: "During the attack, *the percussion pitch is raised.*"

WALSHE (p. 424) declares that "there is little or *no true inspiratory expansion*," and "the resonance on percussion *is slightly impaired.*" Finally, not to multiply citations, Dr. FLINT (p. 397) makes the following explicit statement: "If emphysema be not present, the volume of the lungs may be reduced by the expiratory efforts so as to diminish appreciably the clearness on percussion."

These authors are all original observers, and of the first rank, and yet they agree in making statements to which that of Salter, Wunderlich, Grisolle, and Kidd are diametrically opposed. Now, it would seem almost certain that on the one side or the other, there had either been an error of observation, or in the statement of its results. On the one hand, increased percussion resonance has certainly existed, but on the other hand, in a different set of cases, it has not been present. The passage that has been quoted above from Wunderlich probably explains in some degree this contrariety of statements. This author mentions that after *two or three days* of asthma distention of the thorax is observed. The persistent and prolonged struggle to inspire air tends, by straining the pulmonary tissue, to dilate the vesicles and expand the chest; and, however ineffectual this effort to inspire may be at the commencement of the paroxysm, successive repetitions of the act may add to the amount of air locked up, and, if the attack be a long one, gradually distend the lungs and render the chest resonant upon percussion, where it had previously exhibited diminished resonance. If, then, there are any cases in which at the commencement of a paroxysm the percussion resonance is unnaturally great, there would seem to be a strong probability that they present the complication of emphysema; and if this supposition is correct, *dilatation of the chest is not a characteristic symptom of pure nervous asthma.*

That it *is* probably correct may be inferred from the extreme rarity of *pure* nervous asthma. It is, in fact, one of the rarest among diseases of the lungs. Thus, LAENNEC (*op. cit.*, p. 385) declares—

> "I have found evidence of pulmonary spasm in a very small proportion of asthmatic patients independently of all complication with pulmonary catarrh. Nevertheless, I am able to affirm that this condition exists."

WUNDERLICH informs us (*op. cit.*, p. 312) that, in the course of six years, he found but three cases of it among ten thousand clinical patients.

VALLEIX (*Guide du Méd.*, ii. 562) remarks that, "in the Parisian hospitals, where pulmonary diseases are so carefully studied, cases of nervous asthma are almost never met with."

SANDRAS, in his treatise on Nervous Diseases (ii. 148), after describing some cases of the affection, says: "These exceptional cases constitute nervous asthma."

And, finally, Dr. SALTER, himself, remarks:—

> "Cases of *perfectly pure* asthma, that is, without the slightest organic complication, are, however, rare, unless they have existed a very short time, and for this reason—that asthma, if it is at all severe and its attacks frequent, *cannot long exist without inflicting permanent injury on the lungs, and even on the heart.*"

We cannot follow Dr. Salter in his further analysis of the phenomena of the asthmatic paroxysm, but merely remark that it displays, like the rest of his pathological disquisitions, great familiarity with the phenomena of the disease and accurate reasoning from them. Nor can we dwell upon his interesting illustrations of the periodicity of the attacks.

We merely note, in passing, his statement, that their diurnal occurrence furnishes good grounds for suspecting that they rest upon an organic basis, and also his confirmation of the general testimony of authors that the attacks are more frequent in summer than in winter. The periodicity of asthma, he remarks, is of two kinds; that which depends upon the periodical recurrence of its evident exciting cause, and that which appears to be intrinsic, or, in other words, independent of external circumstances.

It appears, as indeed seems but natural, that the cases which come on in youth and in early manhood, are generally specimens of the pure spasmodic form without organic complication, and, moreover, that they are usually examples of the hereditary transmission of the affection. According to Dr. Salter's observation, twice as many males have asthma as females. We notice that Frank gives the proportion as much larger, viz., as six to one.

The immediate or exciting causes of asthmatic attacks, are generally direct irritants inspired; alimentary irritants; remote sources of nervous irritation, and psychical irritants. Examples of each of these will occur to every reader. The essential causes, our author concludes, may be organic lesions, perhaps inappreciable, either in the bronchial tubes or in some part physiologically connected with them; or else, may consist of some congenital, possibly inherited, peculiarity of constitution, whose nature it is not possible for us at present to apprehend. It may be urged, we think, that an "inappreciable organic lesion" is, practically, something difficult to distinguish from an "idiosyncrasy." It is easy to believe that a certain palpable lesion or peculiar organic condition may be an efficient cause of asthma; but if a lesion ceases to be appreciable, it also ceases to give proof that it exists. In the illustrations adduced by the author, the existence of a lesion is inferred, but not proved.

Although asthma never kills, it may, according to our author, produce certain organic changes in the heart and lungs which ultimately prove fatal. Repeated paroxysms may occasion hypertrophy of the bronchial muscles, and thus diminish the calibre of the tubes, and the bronchitis which so generally complicates the spasmodic affection must still further lessen the supply of air in respiration. It is also remarked, that the greater or less degree of asphyxia existing during the paroxysm shows that the pulmonary circulation is overloaded; serous effusion takes place constituting œdema of the lungs, and the right side of the heart becomes dilated and hypertrophied. Associated with or following these effects emphysema is developed. This last result is ascribed to the strain upon those pulmonary lobules to which the air has access, while the rest are closed by spasm or obstructed with mucus. It is to be observed that all the elements here referred to, except bronchial spasm, are characteristic not of asthma but of emphysema following or accompanying bronchitis independently of any asthmatic complication. To explain through them the development of emphysema in asthmatic persons, is clearly to interpolate causes with which asthma has no necessary connection, and which of themselves are quite sufficient to develope emphysema of the lungs, if an organic predisposition to that disease exists. It is true, that Dr. Salter speaks of having "seen emphysema developed in a case of asthma in which bronchitis never existed." Yet it is certain that the latter disease is not unfrequently the precursor of emphysema, while pure asthma is very rarely, if ever so; hence, we cannot admit any direct causative connection between the nervous and the organic affection. But, still further than this, emphysema is by no means confined to cases in which either asthma, or bronchitis, or heart disease, has previously existed; it more frequently arises spontaneously. This is a fact long ago insisted upon by Louis, who, as well as other writers, has also shown that the disease is very often hereditary, and independent of all exciting causes, and particularly of pulmonary catarrh. It would appear most probable that emphysema is produced by organic conditions involving a diminution of muscular power rather than an excess of it; first, because it oftenest arises without any strain from cough or dyspnœa; and secondly, because, when bronchitis precedes it, the mucous and muscular coats of the bronchia must lose contractile power instead of gaining it. It is also important to remark that emphysema could not be produced by asthma unless the habitual state of the lungs during the paroxysm were one of extreme distention. So long as the chest remains contracted, the strain upon the vesicles, far from being increased, is really less than usual; and it is only towards the end of prolonged paroxysms that the vesicular structure can become dilated. We have endeavoured to prove that constriction, and not expansion, is the ordinary state of the chest during the attack, and the bearing of this proposition upon the relation of emphysema to asthma, will be now apparent.

In considering the treatment of asthma, Dr. Salter first mentions the depressants ipecacuanha, tartar emetic, and tobacco, of which he regards the last as the most speedy and effectual. They afford relief by relaxing the bronchial spasm, and terminating it by reducing the power which generates it. Stimulants, on the other hand, put an end to the attack by exalting the nervous energy above the point at which the reflex susceptibility, on which the spasm depends, has a tendency to display its power in producing muscular contraction. That involuntary and spasmodic muscular action has a peculiar tendency to take place during sleep, the time when the asthmatic paroxysm usually occurs, has already been referred to as a physiological fact. Hence we may explain the usefulness of coffee, tea, alcohol, ammonia, cannabis, ether, and other nervous stimulants in preventing the attacks. Of these, the most favourable judgment is given for coffee. Under the title of "sedatives," as distinguished from "depressants," the author refers again to tobacco, Indian hemp, opium, and stramonium. Undoubtedly these medicines are sedatives of abnormal nervous action, but, except in poisonous doses, they are stimulants, and, in virtue of their stimulant action, assuage morbid nervous action precisely as alcohol allays the "horrors" of the drunkard, or quiets the jactitation, subsultus, and tremors of typhus fever.

Chloroform belongs to the same category. It is by its primary and stimulant operation, and when it is administered in small doses, that it so marvellously arrests the paroxysm of nervous asthma. A case is mentioned by Dr. S. in which a few whiffs of chloroform sufficed to afford relief, and, before insensibility was produced, the breathing was free. Where a marked bronchitic affection exists, the full influence of the medicine would manifestly be dangerous. Objection is made to the use of opium in this disease, and we think with reason. Its stimulant operation can scarcely be obtained without being speedily followed by its narcotic action, and this tends to embarrass rather than to relieve the respiratory organs. In the use of stramonium, the author does not appear to have had much experience, nor to have formed as high an estimate of its virtues as they deserve. Of lobelia, he confesses that he has nothing to say; and the little that he says of sulphuric ether is unfavourable. The inhalation of the fumes of burning nitre paper is a method not, indeed, originating with himself,[1] but one more fully tested by him than by any person who has published his experience in the treatment of asthma. It is evidently his favourite remedy. Its value, he remarks, is in proportion to the purity of the asthma; that is to say, its freedom from organic complications. It was of little use, he found, when the case was complicated with bronchitis. He advises the following mode of preparing and using it:—

> "Dissolve four ounces of saltpetre in half a pint of boiling water; pour the liquor into a small waiter, just wide enough to take the paper; then draw it through the liquor and dry it by the fire; cut it into pieces about four inches square, and burn one or two pieces in the bedroom on retiring to rest at bedtime."

The paper should be unsized, porous, and not containing wool. Red blotting-paper, of moderate substance, is recommended.

Dr. Salter lays down the proposition that asthmatics are generally dyspeptics in a greater or less degree, and furnishes some illustrations of the influence exercised by a disordered stomach upon the recurrence of the attacks, and especially of the mischief occasioned by late and abundant dinners. In this connection, he reminds us again of the greater liability which exists during sleep to all excito-motory impressions, and especially to those which originate in the stomach. All of his precepts are sound, and they possess, what should have been more distinctly recognized, the sanction of long and universal experience. Floyer, in his chapter on this subject, says emphatically: "Asthmatics are best fasting, and under very frugal and simple diet."

One of the most interesting chapters of the present treatise is "On the Therapeutical Influence of Locality." It is there shown by a number of cases that a very large proportion of the asthmatics who come from the country to London are relieved during their residence in that city. The most general principles, or rules rather, which he believes to be deducible from experience in this matter are—

> "That the localities that are the most beneficial to the largest number of cases are large, populous, and smoky cities;" and "that the worse the air for the general health, the better, as a rule, for asthma; thus, the worst part of cities are the best, and conversely."

To these rules, however, the exceptions are numerous, and it is no uncommon thing to find that a particular locality as certainly prevents the paroxysms in one person as it excites them in another. Floyer suffered asthma from childhood until he went from his home in Staffordshire to Oxford, where he resided for twelve years without any considerable fit. He also remarked the greater immunity of asthmatics from their fits in towns, but thought them more severe when they did happen. A similar result of his own observation is given by Trousseau. We believe that the rule also holds in this country. Upon this subject we need make no apology for quoting the following passage from the writings of one of our most sagacious and experienced physicians, the late Professor Chapman:—

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[1] The first published account of this treatment that we have met with is contained in the *New York Med. Gaz.*, i. 375. It was copied into this Journal (Jan. 1842, p. 262), and the editor subjoins: "We can add our testimony to the utility, in some cases, of this remedy. We have several times prescribed it, and in some instances the relief it afforded seemed almost magical; in others, however, it entirely failed." A subsequent reference to the medicine is contained in the *London Lancet*, 1845, i. 383, and ascribes the writer's knowledge of the remedy to a paragraph accidentally seen in a newspaper.

> "The pure air of the country, especially in elevated positions, I have found, with very few exceptions, more pernicious than that of cities, and even the suburbs of these less propitious than the central and populous parts. Many instances have come under my own view of persons affected in this way, who, very comfortable in the latter, were rendered otherwise in the former situation, among which is that of a friend of mine who can seldom walk to the edge of the city with impunity, and never goes into the country without an attack. It sometimes happens, too, that individuals may spend the day comfortably in any rural position, though on the approach of evening they are unavoidably seized. Three or four instances of the kind I have known, and of which there is now living in Baltimore a gentleman by whom I am informed the fact is strikingly illustrated in himself. Close to the town he owns a villa remarkable for its general healthiness, at which he has not slept for many years on this account—escaping, however, all intimations of an attack during the day." (*Lectures on the Diseases of the Thoracic and Abdominal Viscera*, 1844.)

The beneficial influence of sustained bodily exertion is insisted upon very strongly by our author. This, too, is held by Floyer to be an essential part of the treatment, for he assures us that "they who use no exercise in the intervals of the fits soon fall into cachexias, lethargies," &c.; and he advises "riding, sawing, bowling, ringing of a dumb-bell," &c. The avoidance of cold and dampness, and especially of the breathing of damp cold air, is very properly dwelt upon by Dr. Salter as closing one of the principal avenues through which attacks of the disease come on.

By a singular oversight, the author states that he is not sure that the inhalation of oxygen gas has ever been tried. Its use in asthma by Hill, in 1800, is mentioned in so familiar a text-book as Pereira's *Materia Medica;* it had still earlier been recommended by Beddoes and Watt in their treatise on *Factitious Airs;* Chaptal and also Fourcroy tried it in asthma; the authors of the *Compendium de Médecine Pratique* remark that "this agent, which, on theoretical grounds, should have been very efficacious, has not fulfilled the hopes which were entertained of it," and the late Dr. Chapman said of it, "it is dead, and gone to the 'tomb of all the Capulets.'"

The prognosis in spasmodic asthma is, according to Dr. Salter, generally favourable in young patients, but it grows less favourable with advancing age. It need scarcely be added that the prospect of recovery is very much clouded by the presence of any permanent complication either of the lungs or heart. The length of the attacks, their frequency, the rapidity and completeness of recovery from them, their tendency to increase or diminish in number, and the possibility of discovering their immediate exciting causes, are all to be taken into the account, precisely as they should be in any other spasmodic disease.

From the preceding survey, the reader may be enabled to form some idea of the substance and manner of Dr. Salter's treatise, but not such an one as to dispense him from the obligation, or to tempt him from the pleasure, of studying the original. It abounds in the fruits of original observation; its descriptions are full and lifelike; its reasoning is, for the most part, cogent and satisfactory; and its style is remarkably fresh, sprightly, and clear. If a second edition should be published, we shall hope to find in it more frequently due credit given to the older writers for the essential agreement of their views with those which Dr. Salter has so fully and perspicuously expressed. A. S.

ART. XVII.—*General Report of the Commission appointed for Improving the Sanitary Condition of Barracks and Hospitals.* (Presented to both Houses of Parliament by command of Her Majesty. 1861.)

A RECENT report of a royal commission on the sanitary state of the army having shown that the annual deaths among all arms on home stations had reached the great height of 17.5 per 1000, whereas the mortality among males of the same ages, in the town and country population of England and Wales, was at the same time only 9.2 per 1000 (little more than one-half), another commission was appointed by the Secretary of War, consisting of Dr. John Sutherland, W. H. Burrell, and Douglas Galton, engineers, to inquire into the causes of this excessive death-rate, and to devise means for their removal.

For this purpose, they were commanded to "examine and inquire into the sanitary condition of all barracks and military hospitals in the United Kingdom, as regards their position, neighbourhood, construction, drainage, water supply, lavatories, laundries, baths, kitchens, water-closets, latrine arrangements, urinals, means of ventilation, lighting and warming, both by day and by night, the dimensions of the barrack-rooms and sick wards, the arrangements of, and the distance between, the beds, the supply of bedding and utensils, the amount of cubic space per bed in barracks and hospitals, the state of repair of the buildings, the condition as to cleanliness of wards, barrack-rooms, and other buildings, and of their vicinity; and into all other matters connected with the buildings which, in your opinion, may be prejudicial to the health of the soldier."

In addition to this important inquiry, the commission were enjoined to "devise the necessary works and measures required for removing defects in the drainage, for the abolition of cesspools, for the formation of improved drainage, for improvements in water-closets, latrines, and urinals, for providing lavatories, baths, and laundries, for thoroughly and efficiently ventilating all barrack-rooms, wards, and day-rooms, for warming and lighting by day and night, and for improving the kitchens in all barracks and hospitals."

They were further instructed to allot, whenever practicable, in *barracks* and *guard-rooms*, not less than 600 cubic feet to each man, and three feet to intervene between every two beds; while in *hospitals*, 1200 cubic feet were to be allowed for each bed, four feet between the sides of the beds, and twelve feet from foot to foot, when practicable.

These instructions, thorough and minute in every hygienic particular, were coupled with authority to expend a sum not exceeding £100 for each hospital or barrack so inspected; and, whenever that sum was insufficient,